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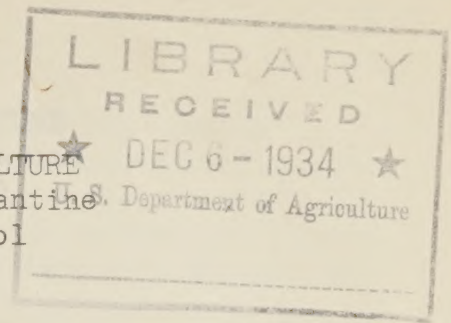




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UNITED STATES DEPARTMENT OF AGRICULTURE  
Bureau of Entomology and Plant Quarantine  
Division of Plant Disease Control



# STEM RUST AND THE COMMON BARBERRY



Pupils in this school have learned to recognize  
common barberry bushes



### JUST PICTURE

Picture a barberry bush  
filled with berries;

Picture a bird  
as the seed he carries;

Picture a tree or fence  
or stone;

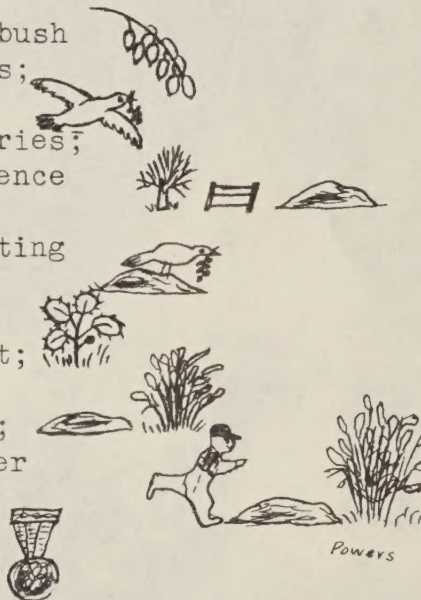
Picture the bird eating  
there alone;

Picture a seed  
beginning to sprout;

Picture a bush,  
Barberry, no doubt;

Picture a Rust Buster  
coming that way--

Picture the medal  
he wears today.



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STEM RUST AND THE COMMON BARBERRY

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INTRODUCTION

Do you realize the importance of plants in our every-day life? Think of any object we eat or wear. Does it not directly or indirectly come from plants? The houses we live in, our furniture, the coal we burn, our writing paper, and the tires for our automobiles are only a few of the many things for which we are dependent on plants.

From man's viewpoint not all plants are useful. A weed is a typical example of a worthless plant that grows in a place where it is not wanted. We often think how much better it would be if there were no quack grass, Canada thistle, sow thistle, mustard, dandelion, creeping jenny, or other common weeds to make trouble in our gardens, lawns, grain fields, and pastures. Many plants, both large and small, are useful, while others are harmful.

Some forms of plant life are so small that they must be studied through the microscope. No doubt you have heard of the tiny plant known as yeast. Many of you have seen it and all of us have eaten it, for yeast is a necessary part of every loaf of raised bread. Yeast consists of tiny plants that belong to a group called fungi. Many other fungi, including larger forms such as toadstools and bracket fungi, grow on dead wood and other waste materials, causing them to rot. Fungi are most helpful to us - in fact, we could not get along without them. If it were not for the fungi and bacteria that live on dead leaves, stems, tree trunks, and the many plants that last for only a season, our forests, roadsides, and fields soon would become so filled with dry, undecayed litter that nothing could grow. Moreover, the soil would in time become so poor as to produce no crops.

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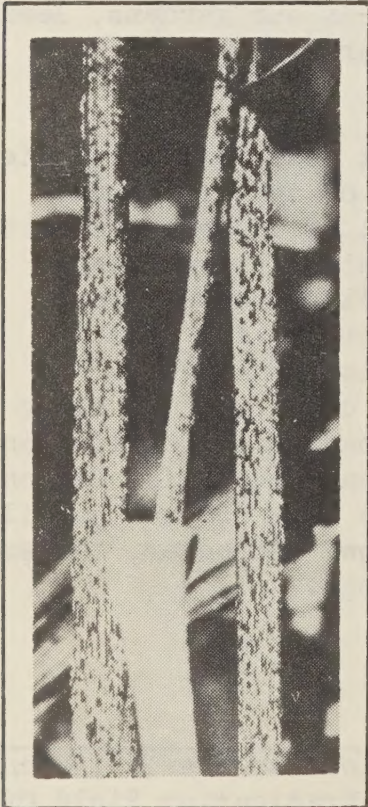
1. The Executive Secretary of the Rust Prevention Association, Minneapolis, Minn., and Leaders in Charge of Barberry Eradication Field Offices gave valuable assistance in the preparation of this pamphlet.



Among the group of tiny fungous plants there are many that are called parasites because they live in or on other plants and steal food from them. In thus obtaining their living they often cause disease resulting in serious injury to the plant. Some produce moldy and decayed spots on fruits and vegetables; others cause smut on corn or small grains; still others cause a disease known as rust on wheat, oats, barley, and rye. Plant diseases often destroy crops valued at millions of dollars. The fungi that cause many of these diseases spread rapidly when the weather is warm and moist.

The life story of the fungus that causes stem rust of wheat, oats, barley, and rye, and the relation of the common barberry to the disease is an interesting story. The manner in which stem rust grows and spreads, injuring grain crops wherever it appears, may be used to illustrate the life story of a very destructive parasitic fungus. Within the brief space of a few weeks in the summer of 1916 our farmers lost more than 180 million bushels of wheat because of the ravages of this disease. In many parts of our country, wheat, oats, barley, and rye are the most important farm crops. Think of all the foods that are made from them -- bread, pies, cookies, breakfast food, shortcakes!

Before 1919, stem-rust epidemics were becoming more numerous and destructive each year. Common barberry bushes planted by our forefathers had been permitted to grow unhindered in the wheat-producing regions of our country. Seeds from the barberry bushes that were planted as hedges, or as decorative shrubs in lawns, orchards, and gardens, were carried by birds to fence rows, rough pasture lands, wooded areas, and other uncultivated places.



Stem rust on wheat

Let us see how rust grows and spreads, what the common barberry looks like, and what we can do to help protect grain crops from being damaged or destroyed by stem rust.

### STEM RUST

What is stem rust?--People were not always familiar with this disease. Many years ago some called it "mildew"; later it was known as "blasting"; now we know it is a disease of wheat, oats, barley, and rye caused by a tiny form of plant life, the rust fungus. Plants, like animals, vary greatly in size, shape, color, and food requirements. The great pine, the mighty oak, the common moss, and the smallest fungus, each is a part of the earth's

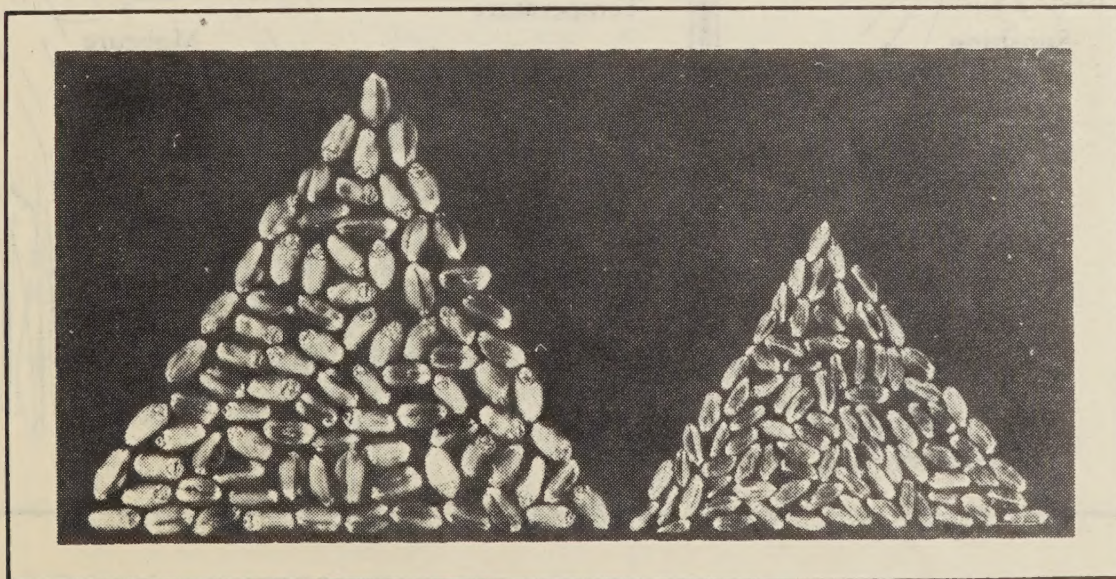


plant life. The fungus that causes stem rust is one of the many thousands of tiny plants seldom seen as we go about our daily work and play. Like other fungi, it has neither green leaves nor roots. It does not make its own food, but depends for its living upon the food it takes from growing wheat, oats, barley, rye, or one of many wild grasses.

What does stem rust look like?--This rust appears in small, elongated dark red or black spots, called pustules, on the stems and leaves of the grains and grasses. These pustules look as though they were filled with a dark red or black dust. This dust is made up of tiny spores or germs that sprout and reproduce the rust fungus. The stem-rust pustules can be easily distinguished from other stem injuries or discolorations by rubbing the finger over them. If the spots are rough and the dusty materials stick to the finger, the injury is undoubtedly caused by the rust fungus, which earlier in the season attacked the growing plant and extended food-gathering threads throughout the tissues of the grain stems and leaves.

Leaf rust, an entirely different disease, also attacks small-grain crops. It, too, produces pustules filled with spores or germs, but they are confined mostly to the leaves. Ordinarily leaf rust is not so destructive as stem rust but often is confused with it.

Just how does stem rust harm the grain crops?--The stem-rust fungus takes from growing plants food that would otherwise be converted into plump, rich grain. It is also true that plants suffering from rust require more water than do those not so afflicted. Sometimes when rust is very bad and the pustules are close together,



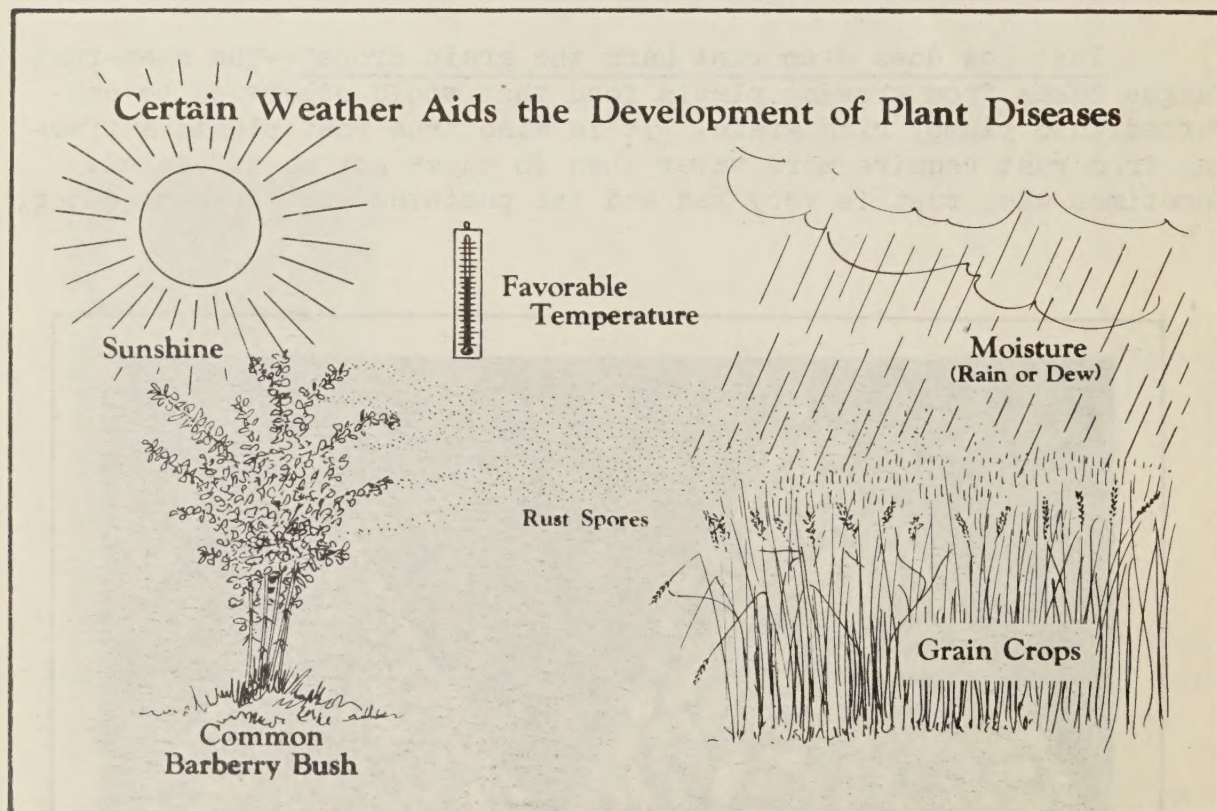
Plump, healthy wheat compared with rust shriveled wheat.  
There are 85 kernels in each triangle.



the straw, greatly weakened by the parasite, breaks over and the grain plant dies. This disease may completely destroy a farmer's grain crop if the rust gets an early start and the weather is warm and moist enough to promote its rapid growth and spread. More often rust steals only a part of the food, causing the under-nourished grain plants to produce small, shriveled, light-weight kernels that sometimes amount to not more than half a crop. Such grain as is harvested is often badly shriveled, and the market value is low.

How does rust spread?--The small, dust-like particles, or spores, that fill the rust pustules on the grain stems, are the germs of the disease. These germs may be carried by the slightest breeze and are often transported for miles by strong winds that sweep across the country. If the spores fall in grain fields and if the weather conditions are favorable, new rust infections will occur. Once the disease appears, it spreads rapidly from one grain plant to another and from field to field.

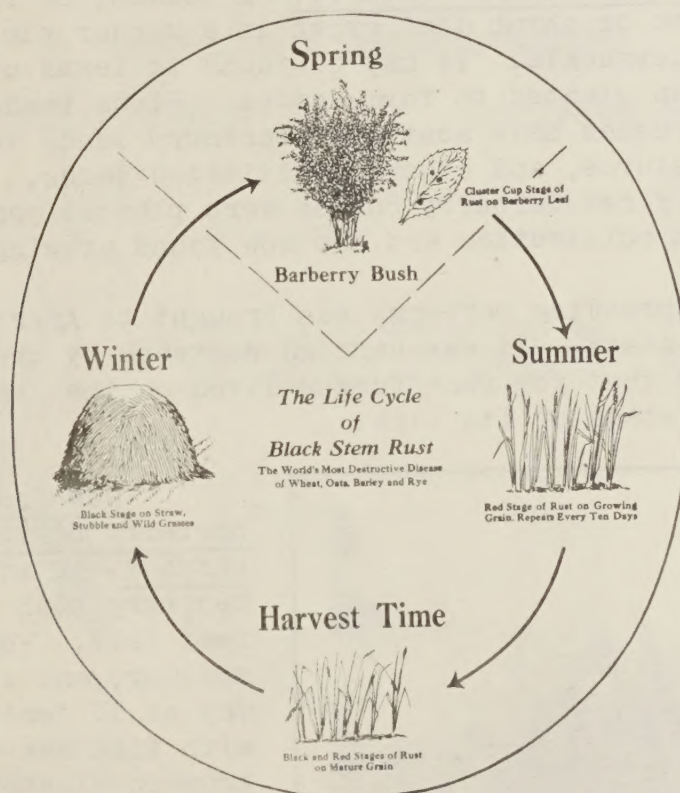
Weather plays a controlling part in the story of rust. Just as the grain plant must have rain and sunshine for normal growth, so also must the rust plant have the right kind of weather. Rust grows and spreads most rapidly on warm, damp days.



When the grain crops ripen, the rust fungus prepares for the winter. Spores, black in color and having thick, protecting walls, develop in great numbers. These remain alive during the winter on



the old straw, stubble, and wild grass. The black, or winter spores, may be compared with the kernels of wheat that the farmers store for seed. In the spring the spores germinate and in a few hours produce smaller spores, which are discharged into the surrounding air. These tiny spores can cause no damage to the new grain crop. They can attack only the leaves and tender growing shoots of the common barberry bush. The spores produced on the barberry are blown about by the wind. If they lodge on the leaves or stems of the grain plant and the weather is warm and moist, they produce a red spot, or pustule. This red stage appears only in the summer when the grain is growing. Thus, the diseased leaves of the barberry become the source of rust infection to the new grain crops.



### Review Questions

1. What is stem rust?
2. Explain why grain plants attacked by rust produce shriveled kernels.
3. What is the color of rust on grain plants during the early summer?
4. What is the color of rust on grain stubble, straw, and wild grasses in the fall?
5. What kind of weather is most favorable for the growth of the tiny rust plants?
6. How far can rust spores travel?
7. Can rust spread from straw and stubble to the new grain crop?
8. On what plants can the black, or winter, spores produce rust in the spring?



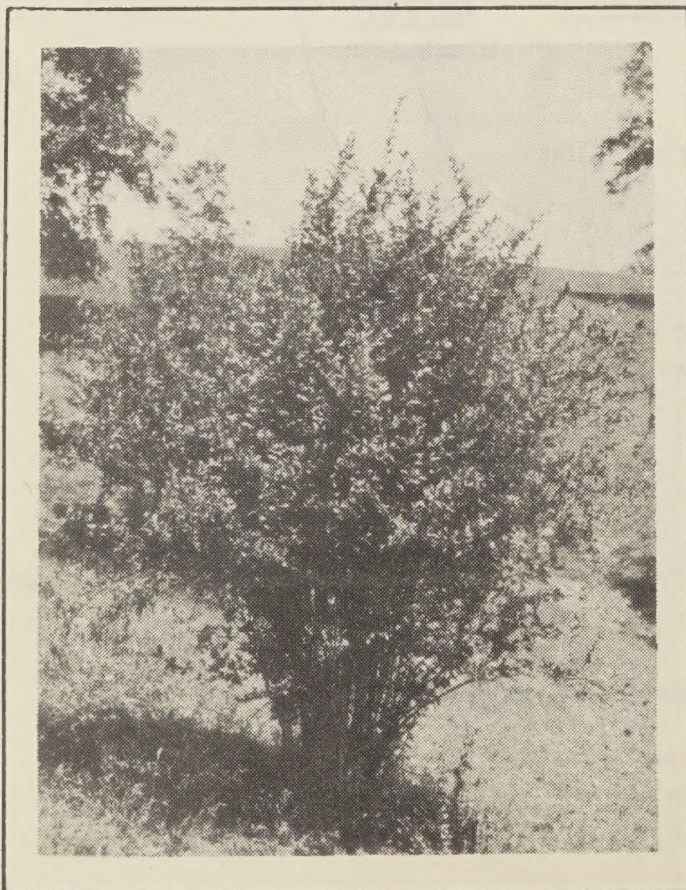
### Suggested Exercises

Have pupils collect straw from straw piles or stubble fields and see if they can find rust spores. Compare a sample of grain shriveled by rust with a sample of plump grain that has not been damaged by the disease. Have the pupils attempt to prepare a list of things that do not come either directly or indirectly from plants.

### THE COMMON (RUST-SPREADING) BARBERRY

Just what is a common barberry?--A common, or rust-spreading, barberry is a bush or shrub that grows in a manner similar to that of a lilac or honeysuckle. It may be found in lawns or dooryards. Often, it has been planted to form hedges. Birds feeding on the berries of planted bushes have scattered barberry seeds to woodlots, stream banks, pastures, and other uncultivated lands. In some localities, where the first barberry bushes were planted years ago, many have escaped from cultivation and are now found growing wild.

The rust-spreading barberry was brought to America from Europe by the early colonists. It was carried westward by the pioneers. They did not know that the rust fungus lived on the leaves of the barberry during one stage of its life.

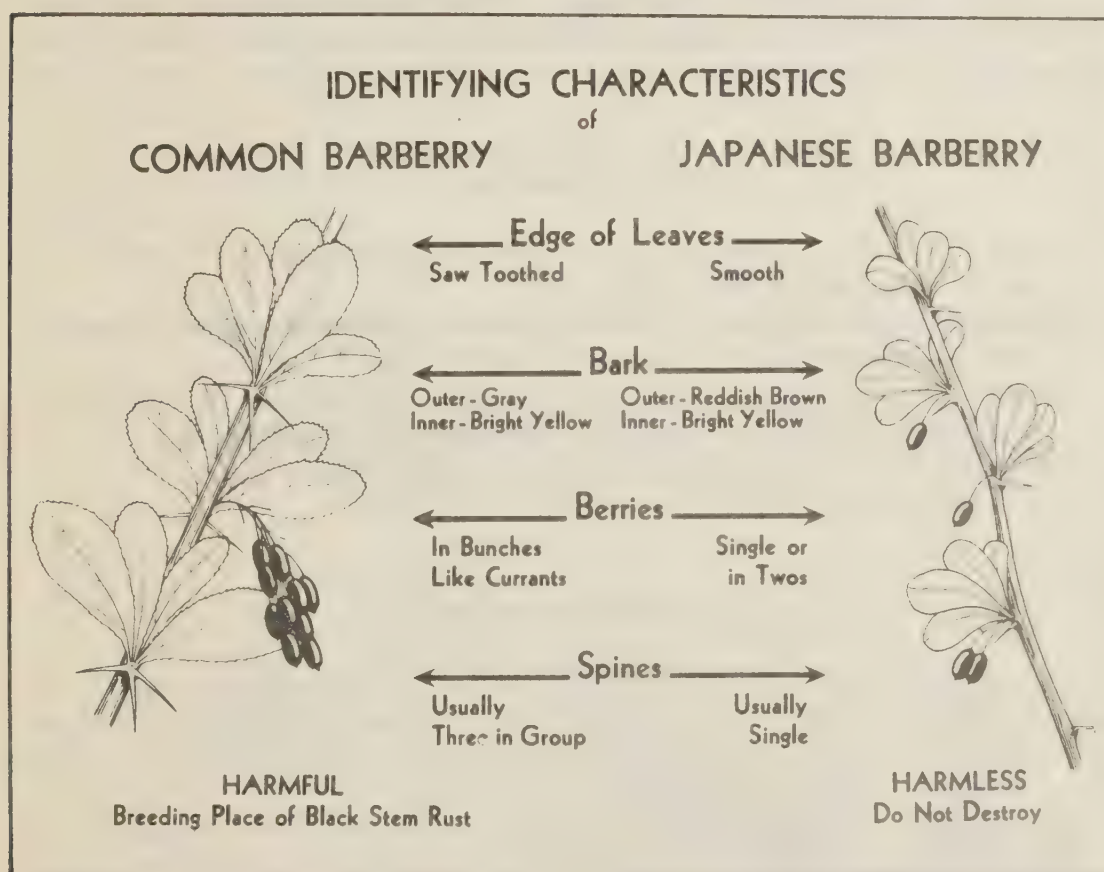


A typical common barberry bush

How does the common barberry differ from other shrubs?--An average-sized barberry bush is from 5 to 6 feet tall. Young plants are smaller, and very old ones may be 15 feet high. Leaves with fine saw-toothed edges grow in clusters on the stems, and directly beneath each group of leaves there are from three to five thorns. In the spring the bush has small yellow flowers. In the summer and fall oval berries, bright red when ripe, hang in clusters similar to currants. The outer bark of the common barberry is gray and the inner bark and roots are bright yellow. It is not difficult to learn to recognize the rust-spreading barberry. Examine closely its leaves, thorns, berries, and roots.



What is a Japanese barberry?--The Japanese barberry is immune to attack by the stem-rust disease and may be grown where desired without endangering small-grain crops. It is a low, spreading type of bush, seldom over 3 or 4 feet tall. In contrast to the common barberry, the leaves of the Japanese barberry have smooth edges; the center bark is reddish brown; the berries are single or in two's; and the thorns are usually single, although they may appear in three's, and are much smaller than the thorns of a common barberry bush.



Every rust-spreading barberry should be destroyed to protect grain crops from destructive epidemics of stem rust.

Why are rust-spreading barberry bushes harmful?--More than three hundred years ago farmers in Europe observed that more rust appeared on the stems of wheat, oats, barley, and rye when these crops were planted near common barberry bushes. However, it was not until 1865 that a German scientist (de Bary) proved this to be true and explained why it was true. He found that the common barberry, as claimed by farmers earlier, actually is the spring home of the stem rust. Without these bushes the rust could not continue, year after year, to live in countries where the winters are severe.



Which is more valuable, the common barberry bush or the grain crops that stem rust destroys?--For many years stem rust has been considered the most destructive of all diseases of small-grain crops. It is estimated that in certain years rust damage has cost the farmers of the United States 100 million dollars. The average loss during the years 1916-21 in 13 of the northern spring-wheat States was more than 50 million bushels of wheat alone. The rust-spreading barberry has value only as a decorative shrub or as a hedge plant. There are other bushes, more attractive than the common barberry and entirely harmless, that can be used for these purposes. For example, lilac, honeysuckle, spirea, and many other decorative shrubs, including the Japanese barberry described above, may be used instead of the rust-spreading barberry.

#### Review Questions

1. Describe the appearance of the rust-spreading barberry bush as to its shape and size.
2. Describe the leaves, thorns, flowers, berries, outer bark, and inner bark of the common barberry.
3. Compare the leaves, berries, and growth habits of the common barberry with those of the Japanese barberry.
4. Where do rust-spreading barberry bushes grow?
5. How are the seeds of this bush scattered?

#### Suggested Exercises

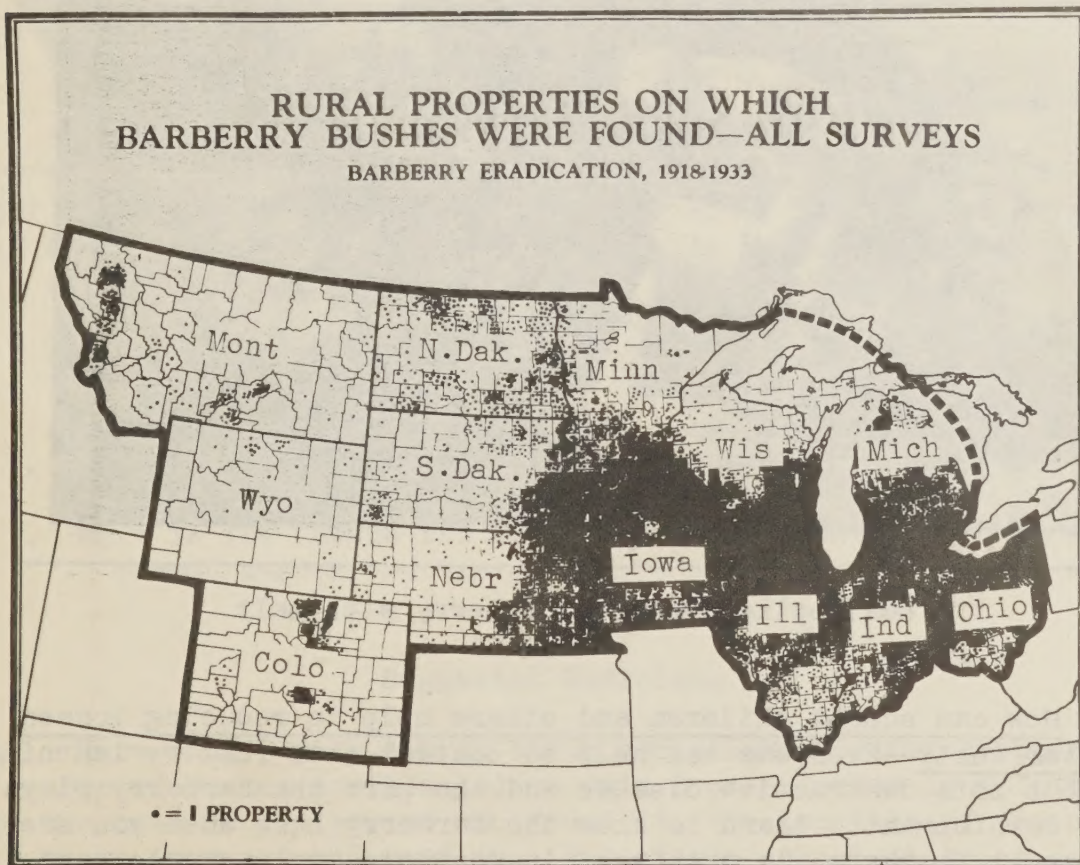
Have pupils make drawings of a twig of the common (rust-spreading) barberry showing leaves, berries, and thorns. Perhaps some of the older pupils can use the subject as a topic for an essay.

The pupils may also make drawings of a twig of Japanese barberry for comparison. Obtain actual specimens of these plants if possible. The younger pupils may wish to color the leaves green, the berries red, and the bark gray. A poster contest in the school may be encouraged and prizes may be offered for the best poster on this subject.



## THE BARBERRY ERADICATION PROJECT

What is being done to get rid of barberry bushes?--Since 1918 the United States Department of Agriculture, cooperating with the 13 States of Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming, and the Conference for the Prevention of Grain Rust, have, with the assistance of school children and property owners, destroyed more than 19 million barberry bushes. Progress in barberry eradication has been accompanied by a definite decrease in the number and severity of stem-rust epidemics. During the 6-year period 1916-21, the amount of wheat lost annually in the North Central States because of stem rust was 50 million bushels; for the 6-year period 1922-27, the average annual loss was 17 million bushels; and for the period 1928-33, the annual loss was reduced to less than 4 million bushels.





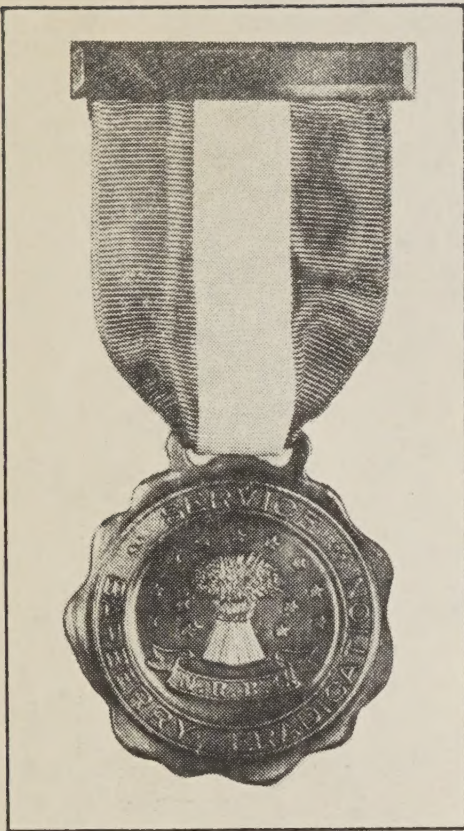
What is the most effective method of killing the harmful barberry?--Crushed rock salt, placed around the crown of a barberry bush, will kill it and no sprouts will appear. Digging a bush is not a very effective method of eradication, because it is difficult to get all the roots. Before killing a bush a twig should be sent to the State Barberry Eradication Office in order to make sure that you are not destroying a harmless and perhaps valuable shrub.



Destroying a common barberry with salt

How can school children and others help in reducing losses from stem rust?--Everyone can help to control stem rust by learning all about this destructive disease and the part the barberry plays in its development. Learn to know the barberry bush when you see it. Look for it in yards, in orchards, in woodlots, in pastures, and along fence rows and streams. A barberry bush may be found growing in almost any locality where there are other trees and shrubs, but is seldom found in fields kept under cultivation.





Medal given for reporting a location of barberries.

Each boy or girl who finds a property having rust-spreading barberry bushes that have not already been reported will be given a medal and certificate of award by the Conference for the Prevention of Grain Rust, Minneapolis, Minn. Send a twig of any bush that you think is a barberry to the State Barberry Eradication Office. All letters pertaining to stem rust or barberry bushes will be promptly answered.

#### Review Questions

1. What is being done in the United States to reduce losses from stem rust?
2. How many States are doing this work?
3. How many barberry bushes have been destroyed in the United States to date?
4. Has there been a noticeable decrease in the losses from stem rust?
5. What should you do before killing bushes that you think are rust-spreading barberries?
6. What can you do to help in this program of stem-rust control?
7. What is the reward for reporting a new location on which common barberries are growing?

#### Suggested Exercises

Have your pupils search their home community for barberries. If suspected bushes are located, a twig 5 or 6 inches long, together with the name of the person who found it, the location of the property where it was found, and the name of the school district, should be sent to the Barberry Eradication Office at your State Agricultural College.



